WHAT IS CLAIMED

Sub B1

1. A process of laser capture microdissection from a specimen having the steps of:

providing a selectively activatable layer which upon activation causes volumetric expansion with an extremity of the volumetric expansion exceeding a first interval taken substantially normal to a surface of the selectively activatable layer;

placing the selectively activatable layer overlying the specimen at a finite separation less than the first interval; and,

selectively activating the selectively activatable layer to cause volumetric expansion at least to the first interval to locally contact a portion of the specimen at the extremity of the volumetric expansion.

2. A process of laser capture microdissection from a specimen according to claim 1 having the steps of:

providing a supporting substrate; and,

adhering the selectively activatable layer to the supporting substrate.

3. A process of laser capture microdissection from a specimen according to claim 1 having the steps of:

visualizing the specimen; and,

selectively activating the selectively activatable layer overlying the desired target within the visualized portion of the specimen.

4. A process of laser capture microdissection from a specimen according to claim 1 where the selectively activating step includes:

forming a mechanical bond with the targeted portion of the specimen.

5. A process of laser capture microdissection from a specimen according to claim 1 having the steps of:

placing a prepared surface on the selectively activatable layer exposed to the specimen, the prepared surface having an affinity specific bond with at least one component of the specimen; and,

selectively activating the selectively activatable layer to cause the prepared surface to contact the specimen and form affinity specific bonds with those components

of the targeted specimen having the specific surface affinity defined by the prepared surface on the activatable layer.

6. A process of laser capture microdissection from a specimen according to claim 1 having the steps of:

repeating the selectively activating of different portions of the selectively activatable layer to cause corresponding contact and capture of different targeted elements within the specimen.

7. A process of laser capture microdissection from a specimen according to claim 6 having the steps of:

moving the selectively activatable layer with respect to the specimen to concentrate the series of captured elements on the activatable layer compared to their spacing within the specimen(s).

8. A process of laser capture microdissection from a specimen having the steps of:

providing a laser activated selectively activatable layer having which upon laser activation causes heat generated volumetric expansion and upon cooling elastically contracts, an extremity of the volumetric expansion exceeding a first interval taken substantially normal to a surface of the selectively activatable layer;

placing the selectively activatable layer overlying the specimen at a separation less than the first interval; and,

selectively activating with laser energy to heat the selectively activatable layer to cause volumetric expansion at least to the first interval to locally contact and bond to a portion of the specimen at the extremity of the volumetric expansion;

removing the laser activation; and,

allowing the volumetric expansion to cool.

9. A process of laser capture microdissection from a specimen according to claim 8 having the steps of:

the allowing the volumetric expansion to cool step causes the volumetric expansion to contract separating the targeted portion of the specimen from a remainder of the specimen and thereby microdissecting the portion of the specimen from a remainder of the specimen.

10. A process of laser capture microdissection from a specimen according to claim 8 having the steps of:

the allowing the volumetric expansion to cool step maintains attachment to the portion of the specimen while elastically tensioning the volumetric expansion of the activatable layer; and,

withdrawing the activatable layer from the specimen to separate the portion of the targeted specimen from the remainder of the specimen thereby microdissecting the portion of the specimen from a remainder of the specimen.

11. A process of laser capture microdissection from a specimen according to claim 10 where the withdrawing the activatable layer step includes:

elastically contracting the volumetric expansion to withdraw the portion of the specimen bonded to the volumetric expansion within the first interval whereby the portion of the specimen bonded to the volumetric expansion cannot contact underlying and remaining portions of the specimen when the activatable layer is maintained separate from the specimen by the first interval.

12. A process of laser capture microdissection from a specimen according to claim 8 having the steps of:

the activatable layer includes strong long chain thermoplastic polymers with a large volume change associated with phase transition.

13. A process of laser capture microdissection from a specimen according to claim 8 having the steps of:

the activatable layer is attached to a supporting substrate.

14. A process of laser capture microdissection from a specimen having the steps of:

providing a selectively activatable layer which upon activation by laser causes volumetric expansion upon heating;

placing the selectively activatable layer overlying the specimen at a separation less than a first interval;

heating and expanding the selectively activatable layer to cause volumetric expansion first by locally heating and expanding a first inner volume of the selectively

activatable layer with a component of expansion normal to the selectively activatable layer; and,

heating and expanding a surrounding second volume of the selectively activatable layer with a component of expansion in a plane of the selectively activatable layer into the first volume whereby a total volumetric expansion occurs with the second volume expanding into and extruding the first volume for a total expansion at least to the first interval to locally contact a portion of the specimen at the extremity of the volumetric expansion.

15. A process of laser capture microdissection from a specimen according to claim 14 having the steps of:

the heating and expanding of the first inner volume includes generating or expanding a vapor bubble.

16. An apparatus for non-contact laser capture microdissection from a visualized specimen, the apparatus comprising:

a support for supporting and viewing the visualized specimen;

a supporting substrate;

a selectively activatable layer maintained on the supporting substrate, the selectively activatable layer upon activation causes volumetric expansion with an extremity of the volumetric expansion exceeding a first interval taken substantially normal to a surface of the selectively activatable layer;

at least a first surface on the selectively activatable layer for contact with the visualized specimen;

apparatus interconnecting the supporting substrate and the support to maintain the selectively activatable layer overlying the specimen at a finite separation less than the first interval whereby upon activation of the selectively activatable layer the selectively activatable layer is brought into contact with the specimen

apparatus for selectively activating the selectively activatable substrate locally to cause the volumetric expansion.

17. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the apparatus interconnecting the supporting substrate and the support is independent of direct contact with the specimen.

18. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the selectively activatable layer maintained on the supporting substrate is activated by laser.

19. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

at least a first surface on the selectively activatable layer for contact with the visualized specimen when the selectively activatable layer is activated by laser.

20. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the supporting substrate and the selectively activatable layer are a tape.

21. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the supporting substrate is a tape and the selectively activatable layer is a coating on the tape.

22. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the first interval is in the range of 5 to 20 microns.

23. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the apparatus interconnecting the supporting substrate and the support to maintain the first surface at a spatial separation from all parts of the visualized specimen includes an air bearing.

24. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the supporting substrate is a convex member.

25. An apparatus for non-contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the supporting substrate is a conical member;

the apparatus interconnecting the supporting substrate and the support to maintain the first surface at a spatial separation from all parts of the visualized specimen includes a rim on a conical member;

a support for the conical member remote from the specimen; and,

the selectively activatable surface constitutes a coating about the conical member.

26. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the supporting substrate is a tape;

the apparatus interconnecting the supporting substrate and the support to maintain the first surface at a spatial separation from all parts of the visualized specimen includes an inert coating of the desired thickness surrounding the active activatable surface on the tape; and,

the selectively activatable surface constitutes a coating on the tape recessed between from the inert coating.

27. An apparatus for non contact microdissection from a visualized specimen according to claim 26, the apparatus comprising:

the inert coating on the tape are on opposite sides of a circle about the selectively activatable surface.

28. An apparatus for non contact microdissection from a visualized specimen according to claim 16, the apparatus comprising:

the selectively activatable surface maintained on the supporting substrate covered by a removable coating, the removable coating having a thickness to define a desired spatial separation between the selectively activatable surface and the specimen whereby upon removal of the removable coating, the selectively activatable coating has the desired spatial separation from the specimen.

29. A method for manufacturing a prepared surface for non contact microdissection from a visualized specimen, the method comprising the steps of:

providing a supporting substrate;

placing a selectively activatable surface on the supporting substrate, the selectively activatable surface upon activation expanding over an interval into contact with the visualized specimen for contact with the visualized specimen;

providing at least a first portion on the supporting substrate for contacting a visualized specimen;

providing at least a second portion on the supporting substrate removed from and supported relative to the first portion on the supporting substrate to maintain the selectively activatable surface at the interval in juxtaposition with respect to the visualized specimen.

30. A method for manufacturing a prepared surface for non contact microdissection from a visualized specimen according to claim 29, the method comprising the further steps of:

the provided supporting substrate is a conical member;

placing a selectively activatable surface on the supporting substrate includes placing the selectively activatable surface on the conical member;

providing at least a second portion on the supporting substrate removed from and supported relative to the first portion on the supporting substrate to maintain the selectively activatable surface at the interval in juxtaposition with respect to the visualized specimen includes placing a rim on a conical member.

31. A method for manufacturing a prepared surface for non contact microdissection from a visualized specimen according to claim 29, the method comprising the further steps of:

the provided supporting substrate is a tape;

the placing of the first portion on the supporting substrate is a first ridge on the tape and a second ridge spaced apart from the first ridge on the tape; and,

the placing of the selectively activatable surface constitutes a coating on the tape recessed between the first ridge and the second ridge on the tape.

32. A method for manufacturing a prepared surface for non contact microdissection from a visualized specimen according to claim 31, the method comprising the further steps of:

placing the first and second ridges on the tape includes placing the ridges on opposite sides of a circle about the selectively activatable surface.

33. A method for manufacturing a prepared surface for non contact microdissection from a visualized specimen according to claim 29, the method comprising the further steps of:

placing a removable coating over at least the selectively activatable surface, the removable coating having a thickness to define a desired spatial separation between the selectively activatable surface and the visualized specimen whereby upon removal of the removable coating, the selectively activatable coating has the desired spatial separation from the visualized specimen.

34. A method for non-contact laser capture microdissection from a visualized specimen, the method comprising the steps of:

providing a support for supporting and viewing the visualized specimen;

providing a supporting substrate;

placing a selectively activatable layer on the supporting substrate, which upon activation causes volumetric expansion with an extremity of the volumetric expansion exceeding a first interval taken substantially normal to a surface of the selectively activatable layer;

placing at least a first surface on the selectively activatable layer or contact with the visualized specimen;

interconnecting the supporting substrate and the support to maintain the first surface at a spatial separation from all parts of the visualized specimen in juxtaposition with respect to the visualized specimen at the first interval of spatial separation from the visualized specimen; and,

locally activating the selectively activatable layer to bring the first surface into contact with the visualized specimen.

35. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

the selectively activatable layer on the supporting substrate has a large volumetric expansion associated with activation.

36. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

activating the selectively activatable layer to bring the first surface into contact with the visualized specimen includes thermoplastic injection of polymer into voids of the tissue sample.

37. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

placing at least a first surface on the selectively activatable layer for contact with the visualized specimen includes providing the first surface with specific tethers for linking to specific cells in the sample.

38. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

placing at least a first surface on the selectively activatable layer for contact with the visualized specimen with a monolayer coating on the surface with high affinity specific bonds for target cells on the visualized specimen.

39. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

placing a selectively activatable layer on the supporting substrate includes placing material having a linear thermal expansion coefficient.

40. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

placing a selectively activatable layer on the supporting substrate includes a material confining local expansion to an internally confined zone on all sides excepting the visualized specimen.

41. A method for non-contact laser capture microdissection from a visualized specimen according to claim 34, the method comprising the steps of:

placing a selectively activatable layer on the supporting substrate includes enclosing at least one air bubble within the selectively activatable layer.

42. A method of laser capture microdissection from a specimen according to claim 34, the method comprising the steps of:

pretreatment of the sample surface with solutions containing element with a specific surface affinity to desired targets as well as a specific surface affinity to the selectively activatable layer.

43. A method of laser capture microdissection from a specimen according to claim 42, the method comprising the steps of:

the pretreatment includes labeling with polymer microspheres (e.g., polystyrene latex spheres) attached to specific affinity tethers which recognize specific target molecules on the surface of the sample elements desired to be captured.

44. A method for non-contact laser capture microdissection from a visualized specimen, the method comprising the steps of:

providing a support for supporting and viewing the visualized specimen;

providing a supporting substrate;

placing a selectively activatable layer on the supporting substrate, which upon activation causes volumetric expansion with an extremity of the volumetric expansion exceeding a first interval taken substantially normal to a surface of the selectively activatable layer;

interconnecting the supporting substrate and the support to maintain the first surface at a spatial separation from all parts of the visualized specimen in juxtaposition with respect to the visualized specimen at the first interval of spatial separation from the visualized specimen;

locally activating the selectively activatable layer to bring the first surface into contact with the visualized specimen at pedestal of material to adhere to the selected portion of the specimen;

separating the selectively activatable layer to microdissect the selected portion of the specimen; and,

after the separating step, locally activating the selectively activatable layer to cause any pedestal protruding from the activatable layer to retract.

45. A method for non-contact laser capture microdissection from a visualized specimen according to claim 44, the method comprising:

utilizing a broader beam of radiation after the separating step to locally activate the selectively activatable layer to cause any pedestal protruding from the activatable layer to retract.

46. A method for non-contact laser capture microdissection from a visualized specimen according to claim 44, the method comprising:

utilizing a lower power beam of radiation after the separating step to locally activate the selectively activatable layer to cause any pedestal protruding from the activatable layer to retract.